

Run-off and Discharge Diagrams

FOR

The Permanent Construction Material

**SALT GLAZED VITRIFIED CLAY
SEWER PIPE AND DRAIN TILE**

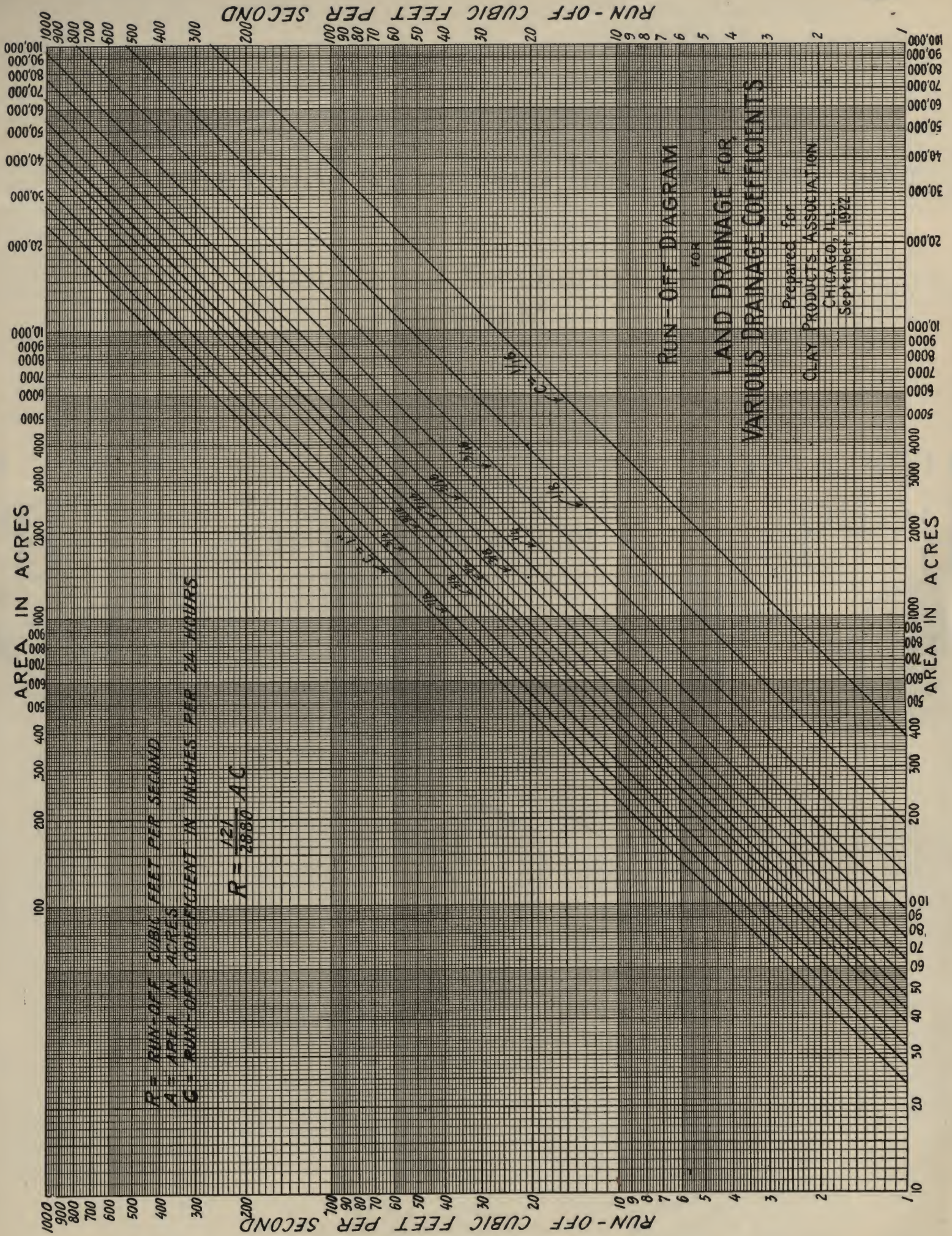
*The Only Material Not Affected by Sewage,
Acids or Alkalies*

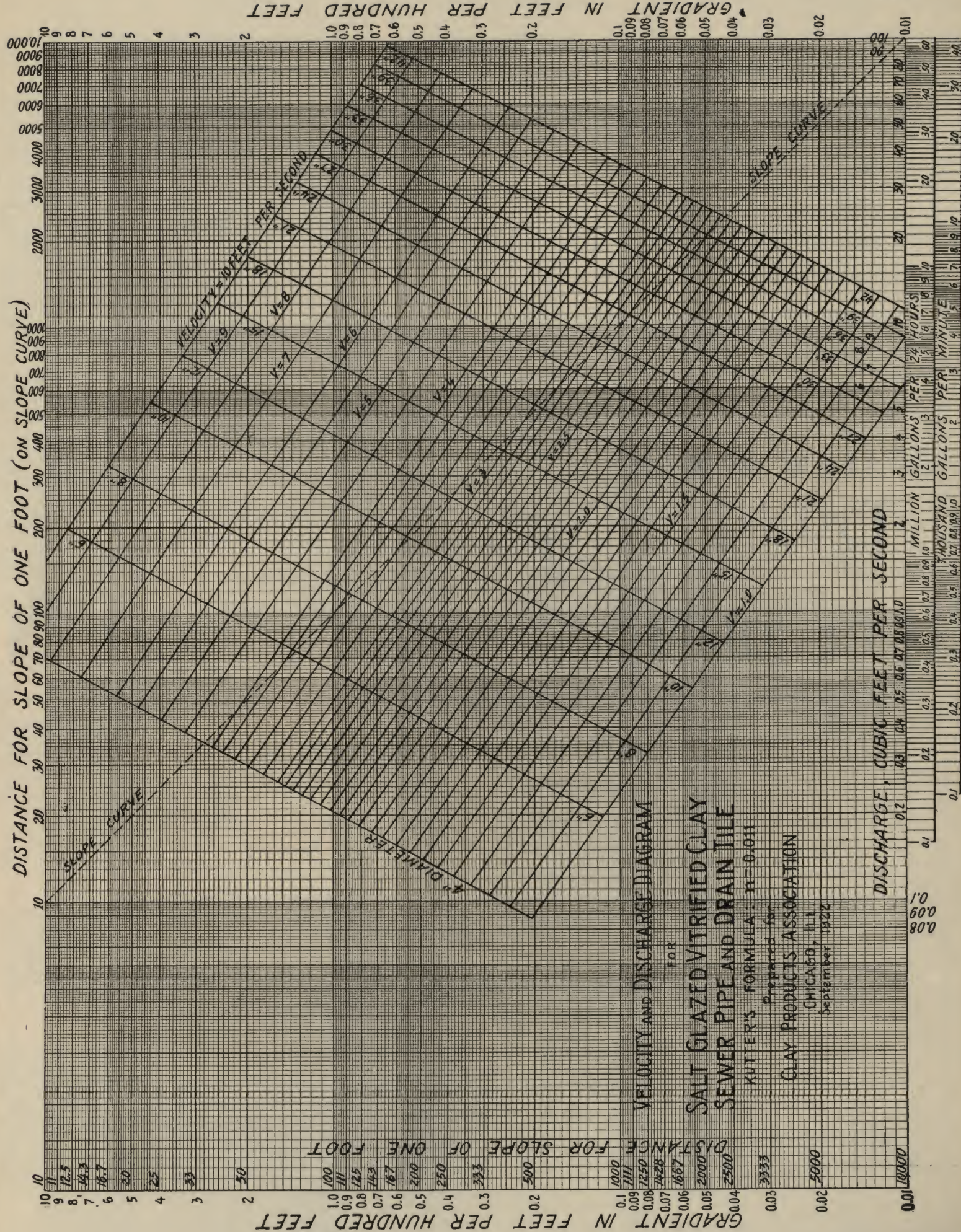


CLAY PRODUCTS ASSOCIATION

**133 West Washington Street
CHICAGO, ILL.**

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THE RUN-OFF DIAGRAM on page 2 has been prepared for drainage work by platting on the horizontal scale the area within watersheds in acres and on the vertical scale, run-off in cubic feet per second. The curves designate the portion of the rainfall or snowfall which passes through the soil to the drain tile. This rate of run-off is usually expressed as the depth in inches removed from a watershed in twenty-four hours. For convenience to the drainage engineer the curves have been prepared with coefficients ranging from $1/16$ of an inch in 24 hours to 1 inch in 24 hours.

In Holland where the annual rainfall ranges from 27 to 40 inches with a total area drained of 43,000 acres, all of which is pumped, and where considerable attention has been given to run-off for drain tile, it has been found that the rate of run-off is $3/8$ of an inch in 24 hours. In the United States the rate of run-off used by drainage engineers varies in the different localities from $3/16$ of an inch to $1/2$ of an inch in 24 hours. Elliott stated some years ago in his treatise on Land Drainage that $1/4$ of an inch in 24 hours will generally prove satisfactory as a coefficient of run-off. Drainage engineers are now inclined, however, to raise this coefficient of run-off from $1/4$ of an inch to $3/8$ of an inch and even as high as $1/2$ of an inch where the precipitation is excessive.

To illustrate the use of the run-off diagram the following example is given: What is the run-off from an area of 640 acres when the run-off coefficient is $3/8$ of an inch in 24 hours? On the horizontal scale locate the 640 acre ordinate and project this vertically into the diagram until it intercepts the $3/8$ of an inch curve. The run-off is found by projecting the point of intersection horizontally to the vertical scale on the right or left which in this case gives a run-off of 10.0 cubic feet per second.

If the problem is to ascertain the acreage in a watershed when the total run-off is 105 cubic feet per second and the co-efficient of run-off is $1/4$ of an inch the result is obtained by projecting the 105 ordinate horizontally from the vertical scale to the $1/4$ of an inch curve and then by projecting the point of intersection vertically the area in acres on the horizontal scale is found to be 10,000 acres.

THE VELOCITY AND DISCHARGE DIAGRAM FOR SALT GLAZED VITRIFIED CLAY SEWER PIPE AND DRAIN TILE on page 3 has been prepared by platting on the horizontal scale the discharge of circular pipes in cubic feet per second when flowing full and on the vertical scale the gradient of the pipe or drain is feet per hundred feet. The curves designated " $V = 1.0$ " etc., represent the velocity in feet per second of circular pipes when flowing full. The curves designate "4 inch diameter," etc., to represent the diameter in inches of *salt glazed vitrified drain tile* for various gradients, capacities, etc. For convenience there has been added conversion diagrams so that the discharge or capacity in cubic feet per second on the horizontal scale can be converted to million gallons per 24 hours or to thousand gallons per minute, which quantities are convenient when pumping problems are involved.

As a further aid to drainage engineers a slope curve has been projected upon this diagram so that the distance for a slope or drop of one foot can easily be obtained or converted to gradient in feet per hundred feet.

In the example given in the use of the run-off diagram it was found that the total run-off for an area of 640 acres was 10.0 cubic feet per second when the run-off coefficient was $3/8$ of an inch in 24 hours. What is the diameter and gradient of a *salt glazed vitrified drain tile* that is necessary to carry the above run-off with a minimum velocity when flowing full of 2.5 feet per second? Referring to the horizontal scale of the diagram and projecting the ordinate 10.0 cubic feet per second vertically into the diagram to where it intersects the curve $V = 2.5$ and then projecting this point of intersection horizontally to the right the gradient is found to be eight hundredths of a foot per hundred feet and the diameter is the nearest curve to the point of intersection of the velocity curve and the discharge ordinate which in this case is 27 inches in diameter.

As a further example in the use of these diagrams, what is the permissible area of a watershed tributary to an 18-inch *salt glazed vitrified drain tile* which was found to have a fall of 1 foot in 2500 feet at the lower end when the run-off coefficient is $1/4$ of an inch in 24 hours? On diagram two, one foot in 2500 feet represents a gradient of four hundredths of a foot per hundred feet. Following this ordinate horizontally to where it intersects the 18-inch diameter curve and projecting this point of intersection vertically downward the discharge ordinate is 2.3 cubic feet per second. Referring to diagram one, where in this case the run-off should equal the capacity of the *salt glazed vitrified drain tile* and projecting the 2.3 cubic feet run-off ordinate horizontally to the point of intersection with the $1/4$ of an inch coefficient curve and projecting this point of intersection vertically downward the area within the watershed is found to be 220 acres.

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intersection vertically downward the discharge ordinate is 2.3 cubic feet per second. Referring to diagram one, where in this case the run-off should equal the capacity of the salt glazed vitrified drain tile and projecting the 2.3 cubic feet run-off ordinate horizontally to the point of intersection with the $\frac{1}{4}$ of an inch coefficient curve and projecting this point of intersection vertically downward the area within the watershed is found to be 220 acres.

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